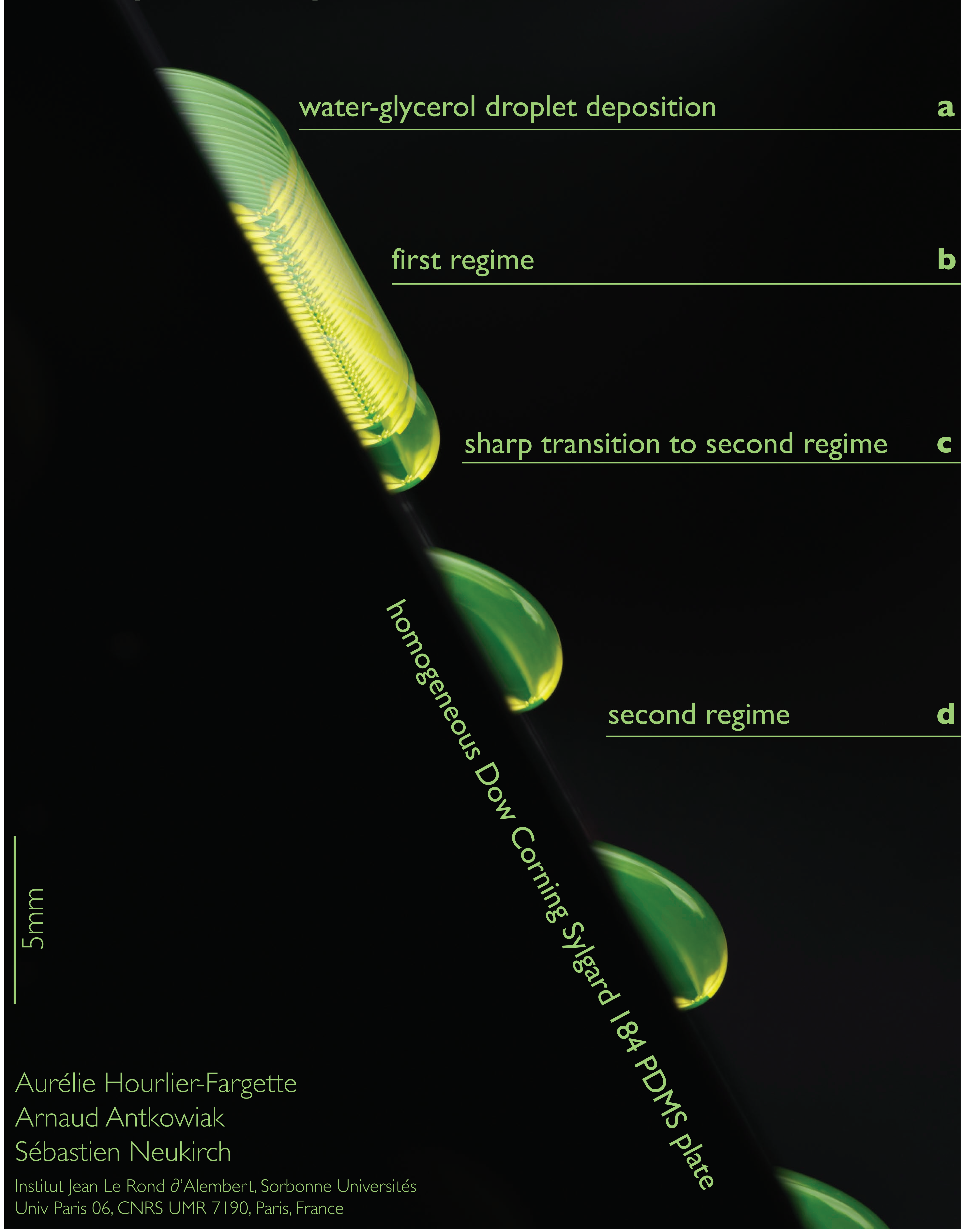
One droplet, two regimes:

Unexpected dynamics on silicone elastomers



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A 40% water 60% glycerol mixture droplet of volume 24 microliters deposited on an inclined PDMS (polydimethylsiloxane) plane. Snapshots are taken every second and superimposed.

a **A water-glycerol mixture droplet** (dyed with fluorescein) **is deposited on an inclined** Sylgard 184 **PDMS plate with a micropipette.**

b **The droplet begins sliding down at a constant speed**, determined by the competition between gravity, viscosity, and capillary pinning forces.

c **The droplet suddently accelerates** (without any modification of the substrate which is a homogeneous PDMS plate), **which was unexpected.**

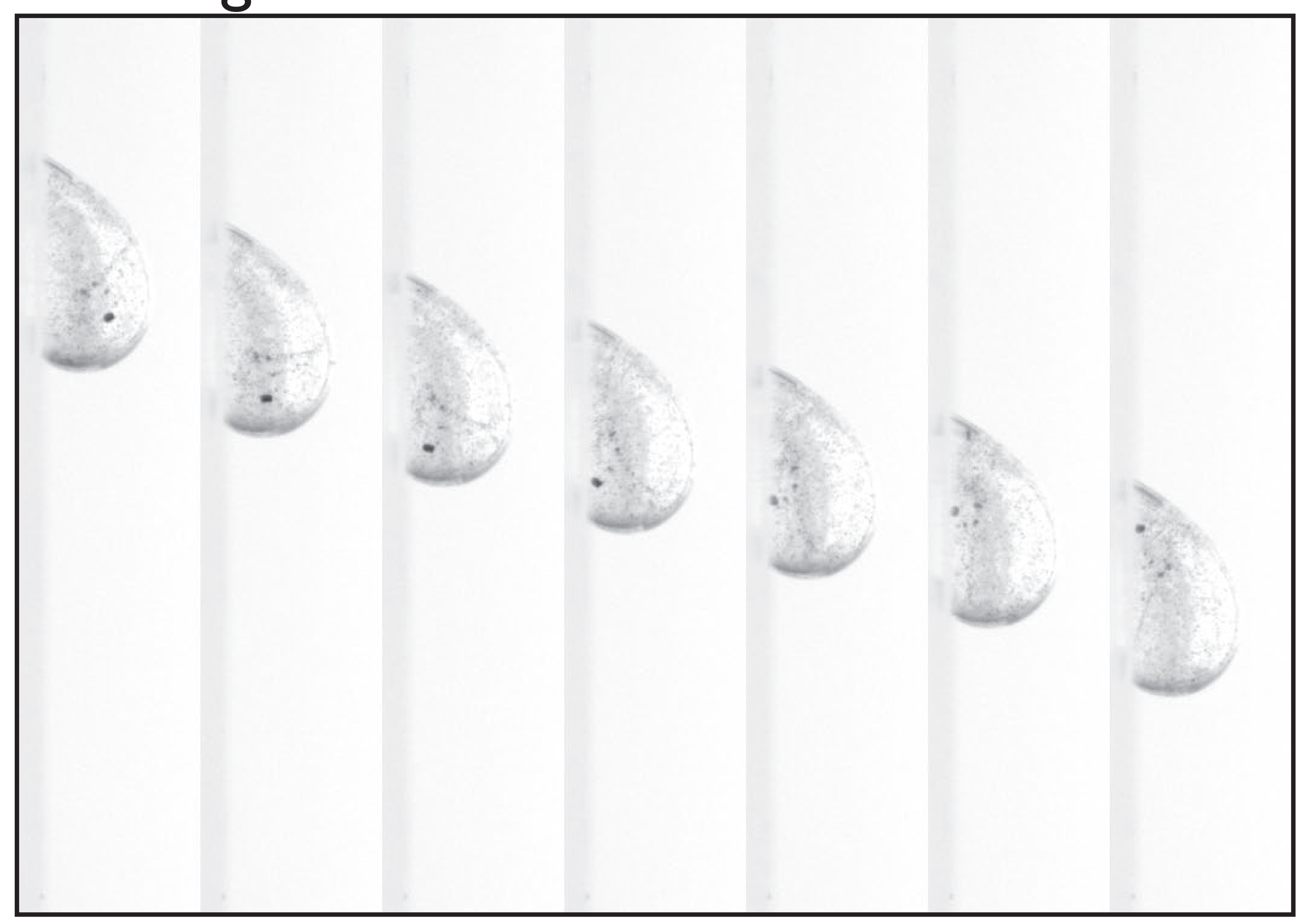
d The droplet reaches **a second regime with a faster constant speed.**

Why two regimes?

Any difference in motion inside the droplet?

A 40% water - 60% glycerol mixture droplet of volume 17 microliters is deposited on a vertical PDMS plate.
Snapshots are taken every second for the first regime and every 0.2 second for the second regime.

First regime

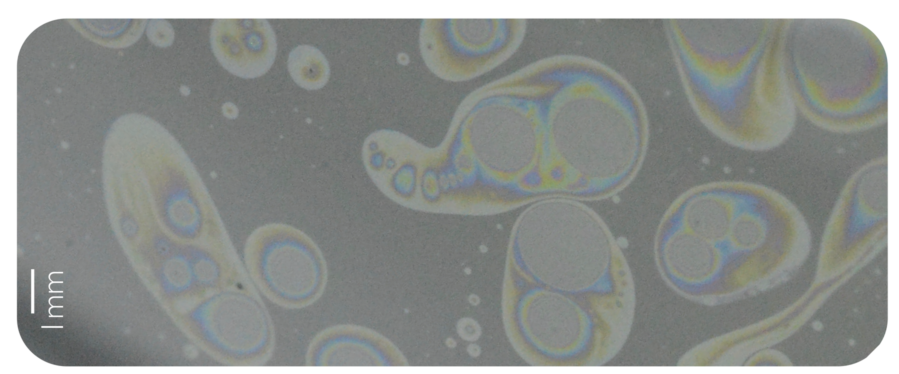


Second regime

A **rolling motion** is observed inside the droplet **in both regimes**: the speed change is not explained by a sliding to rolling transition.

Any change in interfacial properties?

The **surface tension** of the droplet is the initial surface tension of the water-glycerol mixture during the whole first regime. It **suddenly changes** to a lower value at the speed transition. This is due to the presence of **uncrosslinked silicone chains** collected progressively by the droplet during its descent on the elastomer. Extraction of uncrosslinked chains from the elastomer prior to the experiment leads to the disparition of the second regime.
The transition to the second speed regime occurs when a complete layer of uncrosslinked chains is formed on the droplet.



Uncrosslinked chains collected by one single droplet are invisible to the naked eye, but **collection of 1500 water droplets** of 33 microliters in a high beaker after their two-regime descent on PDMS leads to **interference colors** showing the presence of an oil film at the surface of the beaker.

A. Hourlier-Fargette, A. Antkowiak, A. Chateauminois, S. Neukirch,
Role of uncrosslinked chains in droplet dynamics on elastomers,
Soft Matter, 2017, **13**, 3484-3491